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Locating Ducts Within Conditioned Space

AIR DISTRIBUTION SYSTEM IMPROVEMENTS

The U.S. Environmental Protection Agency's **Energy Star® Homes Program** promotes the use of high-efficiency technologies and equipment. Energy Star Homes use at least 30% less energy than homes built to meet the national Model Energy Code while maintaining or improving indoor air quality. These fact sheets are designed to help consumers learn more about the energy-efficient improvements to their Energy Star Homes.

In many homes, the air distribution ducts are located in unconditioned spaces such as attics, crawlspaces, garages, and basements. Residential duct systems located in these spaces can lose between 20 and 35 percent of the energy in the air they distribute. These losses can almost entirely be eliminated by simply locating the ducts within the conditioned space (insulated building envelope).

Figure 1 shows a residence with a "slab-on-grade" foundation, a common construction practice in southern states. With this type of foundation, supply air ducts are typically located in the attic. During the winter, attic air temperatures tend to match outdoor air temperatures. During the summer, solar heat gains can raise attic air temperatures over 150° Fahrenheit. These temperature extremes increase heat losses and gains due to conduction and radiation and decrease duct efficiency. In addition, any conditioned air that leaks out of the duct is lost into the attic.

Figure 2 shows that by constructing a ceiling plenum in the hallway, the ducts can be located within the conditioned space. Air temperatures in this location are typically between 55° and 85° which will minimize conduction and radiation losses. Air that leaks out of the ducts goes into the conditioned space.

In two-story homes, ducts can be located between the first and second floor and interior walls to fall within the insulated space. However, where holes in framing allow air to move freely between these framing cavities and unconditioned spaces (like the attic), these spaces are not within the air barrier.

Ducts within the conditioned space still require minimal insulation and air sealing. Insulation is needed in hot and humid areas to prevent condensation from forming on cold duct surfaces. The amount of insulation required is substantially less than for ducts in unconditioned spaces. A value of R-2 to R-4 should be sufficient. Air sealing the ducts is still required to assure proper air distribution and maintain good indoor air quality.

The Energy Star Homes Program promotes the installation of ducts within the conditioned space as a means of increasing heating and cooling equipment efficiency and lowering utility bills.

Figure 1: Ducts in Unconditioned Spaces

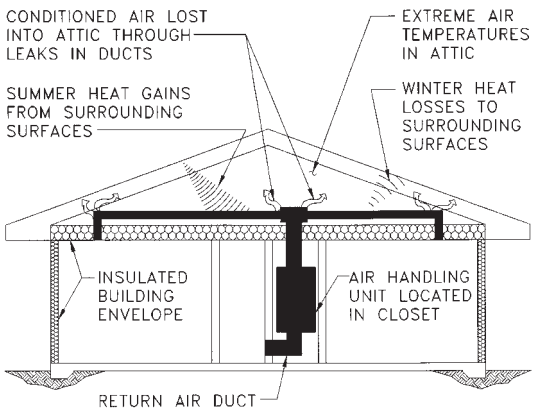
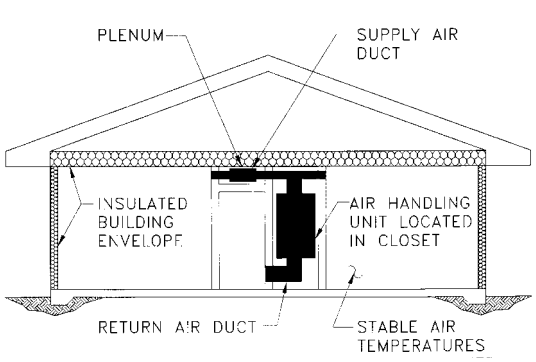


Figure 2: Ducts Within Conditioned Spaces



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Resources

The following fact sheets are available by calling the U.S. Environmental Protection Agency's toll-free Energy Star Hotline at 1-888-STAR-YES (1-888-782-7937): ***Duct Insulation, Duct Sealing, Right-Sized/Compact Ducts,*** and ***Air Sealing***.

Bigger Is Not Better consumer brochure available from the Environmental Protection Agency's Energy Star Hotline at 1-888-STAR-YES (1-888-782-7937).

Benefits

Locating ducts within conditioned space can provide many benefits including:

Improved comfort. Ducts within the conditioned space can better deliver conditioned air at design temperature. This can result in quicker recovery from night-time setbacks and a more consistent level of comfort throughout a house.

Improved indoor air quality. Leaky return ducts located in attics, unfinished basements, crawlspaces, and garages can draw dirt, dust, mold, fumes from stored solvents, radon gas, and carbon monoxide exhaust from cars into homes. By locating ducts within conditioned spaces, only indoor air is drawn into any return duct leaks. This can reduce the amount of airborne pollutants that enter homes and therefore improve indoor air quality.

Lower utility bills. The average homeowner spends more than $600 on space heating and cooling per year. Locating the ducts within conditioned spaces can reduce annual heating utility bills by approximately $200, making homes less expensive to operate.

Lower equipment cost. Ducts within conditioned space can be smaller, or "right-sized." This makes them less expensive and easier to fit within floor and wall cavities. In addition, decreasing the heating and cooling loads can allow for the installation of smaller, less costly heating and cooling equipment.